

# An Advisory Exam in Mathematics

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*The mathematics department at the University of Alberta gave the following 50-minute examination to 2629 students in its introductory calculus courses at the beginning of the 1982 fall term. The mean score was 11.92. Those students whose background appeared weak were advised to participate in the mathematics remedial program.*

## Advisory Exam Statistics

Table I gives the percentage of students answering each of the 25 questions correctly.

Table II gives the relative frequency (R.F.) and cumulative frequency (C.F.) for each of the possible scores (that is, 0 to 25).

Table I		Table II		
Question	Percentage	Score	R.F.	C.F.
1	77	0	0.3	0.3
2	37	1	0.6	0.9
3	56	2	0.6	1.6
4	64	3	2.1	3.6
5	66	4	3.0	6.7
6	22	5	4.0	10.6
7	26	6	5.5	16.1
8	60	7	6.2	22.3
9	82	8	7.0	29.3
10	62	9	7.6	36.9
11	61	10	6.9	43.8
12	31	11	7.1	50.9
13	24	12	6.7	57.6
14	17	13	5.2	62.8
15	47	14	5.6	68.4
16	23	15	5.6	74.1
17	58	16	5.2	79.2
18	41	17	4.4	83.6
19	55	18	3.5	87.1
20	49	19	3.1	90.1
21	59	20	2.7	92.8
22	46	21	2.0	94.8
23	39	22	2.3	97.1
24	40	23	1.3	98.4
25	50	24	1.0	99.4
		25	0.6	100.0

1. If  $\frac{1}{x-5} + 3 = \frac{x}{x-5}$ , then  $x =$

- (a) -2    (b) 1    (c) 2    (d) 4    (e) 7
- 

2.  $\frac{2x}{x^2-1} - \frac{1}{x-1} =$

- (a)  $\frac{1}{x-1}$     (b)  $\frac{1}{x+1}$     (c)  $\frac{2x-1}{x^2-1}$     (d)  $x-1$     (e)  $x+1$
- 

3. Suppose the sides of a rectangle with length  $x$  and width  $y$  are each increased by  $h$ . The increase in the area of the rectangle is

- (a)  $h^2$     (b)  $xh+yh+h^2$     (c)  $xh+yh$     (d)  $xy$     (e)  $xyh$
- 

4. If the equation  $(x-k)^2 = k^2+2x+x^2$  is to be true for all  $x$ , then  $k =$

- (a) -2    (b) -1    (c) 0    (d) 1    (e) 2
- 

5. The solutions of  $(5y-1)(y+1) = 8y$  are

- (a) 1,0    (b)  $-1, -\frac{1}{5}$     (c)  $-\frac{1}{5}, 1$     (d)  $\frac{1}{2}, -\frac{1}{2}$     (e)  $\frac{1}{5}, -1$
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6. The polynomial equation  $x^5-16x = 0$  has how many real roots?

- (a) 1    (b) 2    (c) 3    (d) 4    (e) 5
- 

7. The graph of the parabola  $y = x^2-16x$  is symmetric with respect to the line

- (a)  $x = 8$     (b)  $x = 4$     (c)  $x = -4$     (d)  $y = 4$     (e)  $y = -4$
-

8. The x-coordinate of the intersection of the graphs of  $2x - y = 6$  and  $x + y = -3$  is

- (a) -3      (b) -2      (c) -1      (d) 0      (e) 1
- 

9. A rectangle has vertices at  $(2,3)$ ,  $(8,3)$ ,  $(2,-5)$  and  $(8,-5)$ . The length of a diagonal is

- (a)  $\sqrt{10}$       (b) 6      (c) 10      (d) 40      (e) 100
- 

10. The graph of  $x^2 + y = 1$  is

- (a) a circle with center  $(0,0)$  and radius 1  
(b) a line through  $(0,1)$  with slope -1  
(c) a line through  $(0,1)$  with slope 1  
(d) a parabola with vertex  $(0,1)$  opening downward  
(e) a parabola with vertex  $(0,1)$  opening to the left
- 

11.  $-3 < 5 - 2x < 3$  is equivalent to

- (a)  $x > 1$       (b)  $x < 1$       (c)  $1 < x < 4$       (d)  $-1 < x < 1$   
(e)  $x < 1$  or  $x > 4$
- 

12. The equation  $|x| = -x$  is an identity for

- (a) all  $x \geq 0$       (b) all  $x \leq 0$       (c) only  $x = 0$   
(d) all real numbers      (e) no real numbers
- 

13.  $\log_3 \frac{1}{9} =$

- (a) -3      (b) -2      (c)  $\frac{1}{2}$       (d) 2      (e) 3
-

14. If  $\log_b x = \frac{7}{10}$  and  $\log_b y = \frac{1}{5}$ , then  $\log_b (xy)^2 =$

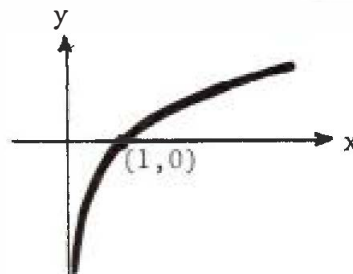
- (a)  $\frac{7}{25}$       (b)  $\frac{81}{25}$       (c)  $\frac{49}{625}$       (d)  $\frac{9}{5}$       (e)  $\frac{81}{100}$
- 

15. If  $x > 0$  and  $y > 0$ , then  $\sqrt{8\sqrt{4x^6y^4}} =$

- (a)  $8xy\sqrt{x}$       (b)  $4xy\sqrt{2x}$       (c)  $4xy\sqrt{x}$       (d)  $4x^2y$       (e)  $4x^3y^2\sqrt{2}$
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16. The given sketch best represents the graph of

- (a)  $y = x^2 - 1$       (b)  $y = \log_{10} x$   
(c)  $y = 10^{-x}$       (d)  $y = 1 - x$   
(e)  $y^2 = x - 1$



17. The number of bacteria in a certain culture at time  $t$  is given by  $N(t) = 2^{kt}$ . If at time  $t = 5$  the number of bacteria equals 32 units, then  $k =$

- (a) 5      (b)  $\frac{1}{2}$       (c)  $-\frac{1}{2}$       (d) 1      (e)  $\frac{6}{5}$
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18. If  $f(x) = 2^x - x^2$ , then  $f(0) - f(-1) =$

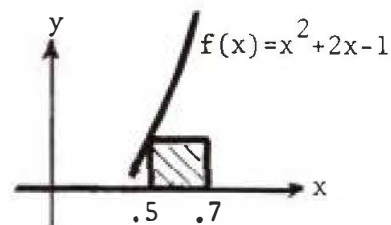
- (a) 5      (b)  $\frac{1}{2}$       (c)  $-\frac{1}{2}$       (d) 1      (e)  $\frac{3}{2}$
- 

19. Let  $f(x) = \sqrt{x^2 - 4}$ . The domain of  $f$  is

- (a)  $|x| \geq 2$       (b)  $|x| \leq 2$       (c)  $x \geq -2$       (d)  $x \leq 2$   
(e) all real numbers
- 

20. The area of the rectangle pictured on the right is

- (a) 0.05      (b) 0.2  
(c) 0.25      (d) 0.35  
(e) 1.2

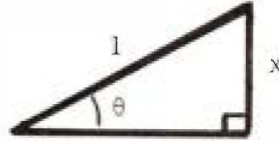


21. The radian measure of the angle  $240^\circ$  is

- (a)  $\frac{\pi}{4}$     (b)  $\frac{3\pi}{4}$     (c)  $\frac{4\pi}{3}$     (d)  $\frac{5\pi}{3}$     (e)  $\frac{2\pi}{3}$
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22. In the right triangle shown,  $\cos \theta =$

- (a)  $x$                       (b)  $x\sqrt{1-x^2}$   
(c)  $x^2+1$                 (d)  $\frac{1-x^2}{2}$   
(e)  $\sqrt{1-x^2}$



23. Which of the following numbers is largest?

- (a)  $\sin(-\pi)$     (b)  $\sin(-\frac{\pi}{2})$     (c)  $\sin 0$     (d)  $\sin \frac{\pi}{2}$     (e)  $\sin \pi$
- 

24.  $\cos(90^\circ - \theta) =$

- (a)  $\cos \theta$     (b)  $-\cos \theta$     (c)  $\sin \theta$     (d)  $-\sin \theta$     (e)  $1 + \cos \theta$
- 

25.  $\frac{(\cos^2 \theta)(\tan \theta)}{\sin \theta} =$

- (a)  $\sin \theta$     (b)  $\cos \theta$     (c)  $\tan \theta$     (d)  $\sin^2 \theta \cos^2 \theta$     (e)  $\sec \theta$
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